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A database of the recreational value of European forests

Design and implementation from recreational valuation studies

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Abstract

In addition to the supply of wood, forests provide many services to humans in terms of climate regulation (e.g. carbon sequestration), air purification, recreation and tourism, fresh water supply, soil protection, habitat for biodiversity and many others. Options for recreation is one of the cultural services provided by forest ecosystems. Cultural forest services include the non-material outputs of forest ecosystems. These services are regarded as the physical settings, locations or situations that produce benefits in the physical, intellectual or spiritual state of people. Nevertheless, valuing non-market services, such as forest for recreation, is challenging without baseline robust and harmonised data. This study aims at designing and developing a database of studies on the recreational value of European forests for value transfer. The database will be populated by a literature review. This study was implemented as part of the traineeship 2014-IPR-H-000-2973 Recreational Value of Forests awarded to Paula Nieto Quintano.

Contents

1. Background

The European Union (EU) Biodiversity Strategy to 2020 (European Commission, 2011) aims at halting the loss of biodiversity and the degradation of ecosystem services in the EU and restoring them in so far as is feasible. In pursuing this aim Action 5 of the Strategy calls Member States of the EU to map and assess the state of ecosystems and their services in their national territory with the assistance of the European Commission. To this purpose the Mapping and Assessment of Ecosystems and their Services (MAES) Working Group[1] has been established supporting actions oriented to mapping and assessment of ecosystems and their services.

More specifically Action 5 of the Strategy establishes that "Member States, with the assistance of the Commission, will map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020". This action works in synergy with the new EU Forest Strategy (European Commission, 2013) which calls to maintain, enhance and restore forest ecosystems and to promote forest multifunctionality. The recreational role of forests is an important aspect of forest multifunctionality, because this service is supplied without diminishing others such as biomass production, habitat for animal and plant species, carbon sequestration, and many others.

The work being carried out in the MAES working group is important for the achievement of biodiversity objectives, and also to inform the development and implementation of related policies on forest, water, climate, agriculture, and regional planning. Robust, reliable and harmonised forest data and indicators are fundamental building blocks for the planning and implementation of individual projects such as Green Infrastructure actions (MAES, 2014). One essential feature of MAES is that it looks at the overall, long-term benefits for human well-being of maintaining healthy biodiversity and resilient ecosystems.

Globally, ecosystems supply services worth trillions of Euro, as the Economics of Ecosystems and Biodiversity study demonstrated (TEEB, 2010). Nevertheless, valuing non-market services, such as forest for recreation, is challenging without baseline robust and harmonised data. A pilot on forest ecosystems and their services was setup in the frame of MAES (2014). The essential task of the pilot is to identify available knowledge useful for mapping forest ecosystems and to assess their condition and the services they provide at local, national and pan-European level. The study described in this report is a contribution to the forest pilot.

This study was implemented as part of the traineeship 2014-IPR-H-000-2973 Recreational Value of Forests. It was carried out in the framework of the activities supporting the MAES forest pilot in the JRC's project Forest Information System for Europe (FISE). One of the FISE activities is the mapping, analysis and economic valuation of forest ecosystem services: current status and future (policy) scenarios.

[1] http://biodiversity.europa.eu/maes

2. Introduction

In addition to the supply of wood, forests provide many services[2] to humans in terms of climate regulation (e.g. carbon sequestration), air purification, recreation and tourism, fresh water supply, soil protection, biodiversity (habitat and gene pool protection) and many others (MAES, 2014).

Options for recreation is one of the cultural services provided by forest ecosystems. Cultural forest services include the non-material outputs of forest ecosystems. These services are regarded as the physical settings, locations or situations that produce benefits in the physical, intellectual or spiritual state of people (Haines-Young and Potschin, 2013). Studies from across Europe show that forests are among the most popular environments for outdoor recreation (Nielsen et al., 2007). Recreation benefits constitute a substantial part of the total non-market economic value of forests, and are important for the design and implementation of multifunctional forest policy options (Bartczak et al., 2008). The value that users confer to forest recreation is substantial; however it is not reflected by market prices and is provided and enjoyed as a quasi-public good (Zandersen and Tol, 2009). From this perspective, taking into consideration the economic value of forests for recreation could provide guidance for the management, conservation and planning options for forest recreation (Zandersen and Tol, 2009). However, there are on-going methodological debates about the accuracy and applicability, and thus, the practical usefulness of existing valuation methods (Elsasser et al., 2009).

Several non-market valuation methods can be applied to estimate the monetary value attached to forest public services, and therefore to the recreational use. These methods can be aggregated into two broad categories: revealed preference (RP) and stated preference (SP). RP methods are based on actual behaviour of users of ecosystem services, assuming that observed behaviour follows from an internal utility maximization process. The most common RP methods include hedonic pricing and travel cost. SP methods use a simulated marked for estimating the price of services using questionnaires. Common SP methods are contingent valuation and choice modelling (Riera et al., 2012). Table 1 describes these methods together with the welfare measure estimated. The next paragraphs include a brief description of each method with information adapted from King and Mazzotta (2000) and EEA (2010).

[2] In this report the term ecosystem services includes both ecosystem services and goods.

Table 1. Valuation methods and associated welfare measures. Source: modified from Brander et al. (2006).

Valuation Method	Short description	Welfare measure
Stated preferences		
Contingent valuation	Survey-based method aimed to obtain the willingness to pay for a specific service in a hypothetical market	Compensating or equivalent surplus
Choice experiments	Survey-based method in which the user of the service makes choices on several hypothetical alternatives	Compensating or equivalent surplus
Revealed preferences		
Travel cost	Estimates the willingness to pay using observed variations in visitation rate and travel costs to visit the site	Consumer surplus
Hedonic pricing	Estimates the willingness to pay using the price of marketed services whose value reflects access to the non-market ecosystem service	Consumer surplus

- **Contingent valuation** is a survey-based method used frequently for valuing non-market ecosystem services. The survey is implemented using a hypothetical market as reference. In the survey, users of the ecosystem service are asked how much they are willing to pay for the provision of that service. The survey is frame-worked by setting a description of the service to be valued, a description of the payment vehicle and a description of the hypothetical market defining providers and users (payers) of the service. The method is called contingent valuation because respondents of the survey are queried to state their willingness to pay, contingent on a specific hypothetical scenario and description of the ecosystem service being valued (EEA, 2010).

  The contingent valuation has for many years been widely applied in recreation and environmental economics; for example in Lindhagen (1996), Scarpa et al. (2000), or Tyrväinen and Väänänen (1998). It is one of the most frequently used methods for valuing non-market forest services (Nielsen et al., 2007).

- **Choice experiment** is a survey-based method. In this method a valuation site, for example a forested area, is described by a number of attributes. Attributes could include availability of a visitor centre, number of rare species, biodiversity level, and entrance fee. Then by varying attribute levels several hypothetical alternatives can be defined. During the survey users are asked to rank their preferred alternatives. In this method respondents indirectly reveal their relative preferences on the basis of different site attributes. Similarly to contingent valuation this is a hypothetical method because it asks users to make choices based on a hypothetical scenario. The main difference with contingent valuation is that respondents should not state their preferences in monetary terms. Here values are deducted from the choices or trade-offs that the users define in the survey.

- **Travel cost** is used to estimate economic use values of ecosystems or sites that are used for recreation. The underlying assumption of this method is that travelling time and expenses necessary to visit a site represent a proxy for the price for accessing the site. Therefore, willingness to pay to visit the site is estimated based on the relationship between visitation rates and travel costs. This approximates estimating users' willingness to pay for a marketed service based on the quantity demanded at different prices (EEA, 2010). The travel cost method is often applied in studies of the recreational value of forests across Europe; i.e. Benson (1989), Mendes (2005) or Zandersen and Tol (2009).

- **Hedonic pricing** is used to estimate economic values for ecosystem services that affect market prices of goods. A common application consists of inferring the economic value of ecosystem services at local level from variations in house prices. The method relates property value and property characteristics, including environmental characteristics of the property such as a beautiful landscape or the proximity to recreational forests or protected areas (EEA, 2010).

In the last few years different studies have been published aiming to estimate the recreational value of forests; i.e. Scarpa et al. (2000), Zandersen and Tol (2009) and many others. Also, there is currently a number of initiatives to collect all these studies in databases; for instance Elsasser et al. (2009) presented the structure and the content of a database on forest valuation studies conducted in France and in the German-speaking countries (Austria, Germany, and Switzerland). These databases are often input to value transfer (benefit transfer) methods that use values of recreational forests, computed using the above mentioned valuation methods, for estimating the value of other forest sites with unknown value.

The **value transfer** approach consists of transferring economic values estimated in previous studies from a study site to another site or sites; i.e. the policy sites, or to the same site at a different time period (Riera et al., 2012; Zandersen and Tol, 2009). The approach uses information in a setting other than that for which it was collected (EEA, 2010; Riera et al., 2012). This is a cost-effective approach due to the fact that it is less expensive than collecting information using surveys; in addition it may be used for evaluating a large number of sites. According to Riera et al. (2012) there are two basic groups of value transfer techniques: unit value transfer and function transfer, including the benefit function transfer and meta-analysis. The database presented in this report is well suited for value transfer studies.

Meta-analysis has been applied to a variety of environmental fields (Zandersen and Tol, 2009). There are several studies using meta-analysis techniques for assessing the recreational value of forests in Europe; i.e. Rekola (2005), Bateman and Jones (2005), Brander et al. (2010), Matthews et al. (2009). Nevertheless, the use of databases for meta-analysis and value transfer has to be made with great prudence (Stenger et al., 2009). Original valuation studies refer to specific local conditions, user preferences, socio-cultural level, and other characteristics. These aspects are often

not included in the original studies and are therefore difficult to represent in a model. In meta-analysis studies, the underlying spatial component has to be taken into consideration as shown in Bateman and Jones (2005) and Voces González et al. (2010).

When the economic value of one or more study sites is to be transferred to a large geographical setting the **scaling-up** approach can be implemented (EEA, 2010). Typically, in a scaling-up approach, economic values computed for services from particular study sites are transferred to another geographical setting, for example to the regional, national or global scale. Therefore local values are used to compute the values of all ecosystems (or ecosystem services) of similar characteristics in a larger geographical region. Scaling-up is considered as an extension, or specific case, of value transfer (EEA, 2010). Despite this method being a cost-effective approach for valuation of large ecosystems, such as forests at pan-European level, it is subject to several constraints that may lead to increased uncertainty. For example, information of baseline studies may be skewed towards more valuable areas or more populated areas, thus leading to under-sampling in other regions. A second drawback is the issue of aggregation, since information of baseline studies refers to specific cases in isolation; i.e. without taking into consideration the effect of abundance or scarcity of the service, something that should be considered when assessing large geographical regions. Other issues are discussed in more detail in EEA (2010) and Brander et al. (2010).

3. Objectives

The main objectives of this study are:

1. The design and implementation of a database of studies on the recreational value of European forests for value transfer. The database will be populated by a literature review.
2. First identification of explicative spatial variables of the recreational value of forests useful for value transfer using GIS modelling.

4. Methodology

This section describes the methodological steps used in this study. The first step is database design, followed by the literature review and its results. The next step consists of standardising the values in the database to a common currency and reference year. Finally we describe the geo-referencing process and spatial distribution of the records in the database.

4.1 Database design

A database was designed in Excel. The database is subdivided into records that constitute the rows of the Excel file. For each record there are 27 descriptors (columns) which characterise the source publication(s), the valuation object, details of the statistical and economic methods applied, the

results of the valuation exercise and a few other ancillary descriptors. The selection of these descriptors was inspired by the data fields in other existing valuation databases. Additionally, each record has a unique identifier, and corresponds to a valuation of a specific site. Table 2 shows the descriptors of the database.

Table 2. Descriptors of the database of forest valuation studies.

Study descriptors	**Reference Id**: Index number given for each entry (XXX)
	Source: Indicates the main source of the study (e.g. existing database e.g. EVRI, Scopus, etc.)
	Study name: Name of the author(s) and year (Author's name, Title)
	Study title: Title of the main source (Author's name, Title)
	Publication type: Type of publication (e.g. Journal review, Ph.D. study, conference paper, research project)
	Publication link: Online link of the study (http)
	Year: Year of publication of the study (since 1990) (YYYY)
Valuation object descriptors	**Dominant Land cover:** Dominant land cover of the study area (e.g. Forest, heathland)
	Protected area: Indicates if the study area is protected (Y/N)
	Urban Green Area: Indicates if the study area is an Urban Green Area (Y/N)
	Country: Country of the study (e.g. IT, ES, GR)
	Region: More detailed description of the location of the valued recreational service (e.g. province, area)
	Domain of application: Extent of the study area (e.g. National, Regional, local)
	Geo-reference: Coordinates of the centroid of the study area (X,Y)
	Forest area: Size of forest area in Ha. (Ha.)
	Recreation area: Size of recreational area in Ha. (Ha.)
Valuation method descriptors and results	**Method:** applied valuation approach (travel cost method (TCM), contingent valuation method (CVM), contingent behaviour method (CBM), benefit transfer (BT), choice experiment (CE)) (TCM / CVM / CBM / BT/ CE / na)
	YearOD: Year of original data (YYYY)
	YearEV: Reference year of the economic valuation (inflation reference year) (YYYY)
	Average/Marginal value: Defines if the value is Average or Marginal, both expressed in (€/Ha/year) (A/M)
	No. of visitors: Number of visitors per year (visitors/year)
	WTP: Willingness To Pay (€/day/visit)
	Currency: Currency used in the valuation (e.g. Euros (€), Pounds (£), Swedish krona (Kr), etc.)
	Value Forest area: Value of the Recreational Area per Ha. (€/Ha/year)
	Value Recreation area: Value of the Recreational Area per Ha. (€/Ha/year)
	Total Value (€/year)
Other	**Remarks**: Other observations of the study not included on the other fields (e.g. Temporal scale

4.2 Literature review

To elaborate a comprehensive database of the recreational value of forests in Europe, we performed a literature review, attempting to collect as many of the available references as possible, for the purpose of conducting a value transfer. The methods employed in the literature retrieval included searching existing databases, electronic journal databases, and contacting with experts and relevant agencies. The literature review focused on studies from 1990 in all European countries and using any valuation method. However, studies that included data evaluated in 1988 and 1989 were also included, as many studies from these years were found. The literature review was performed in English, although studies in Spanish, German and French were also included.

FOREST VALUATION DATABASES

First, we focused on finding available databases on forest valuation studies.

When including records from an existing database, the original document was consulted wherever possible. When the original document was found, and in case of disconformity with the values found in an existing database, the values of the original document were the ones included in our database.

The existing databases used are:

- **Environmental Valuation Reference Inventory [EVRI]**: The worldwide web-based database EVRI, which was initiated by Environment Canada and the USEPA covers all non-market goods including the different environmental goods and services related to forests. The EVRI is a searchable storehouse of empirical studies on the economic value of environmental benefits and human health effects. It was developed as a tool to help policy analysts use the benefits transfer approach (EVRI, 2014). Source: https://www.evri.ca/

  The information in the EVRI is available only to subscribers. At present, the UK and France are the only European countries that subscribe to EVRI.

- **Ecosystem Service Valuation Database (ESVD)**: Within the context of the TEEB project (2008-2010) the authors of the global overview of the "Estimates of monetary values of ecosystem services", supported by many ESP-members and TEEB researchers, developed a database on monetary values of ecosystem services which currently contains over 1,350 data-points from over 300 case studies. The database is continuously under development. The aims of the ESVD are to compile, share and review data on economic valuation studies of ecosystem services and to support education on sustainable land management. The database is provided in Excel format (Van der Ploeg, 2010). Source: http://www.fsd.nl/esp/80763/5/0/50

- **ValueBase Sweden** (Sundberg and Söderqvist, 2004): ValueBase was developed by the Swedish Beijer Institute. It contains more than 170 valuation studies from Sweden. A drawback with this database is the absence of area specifications (e.g. hectares) related to

the economic estimates (Sundberg and Söderqvist, 2004). ValueBase is disseminated in Excel format. Source: http://www.beijer.kva.se/valuebase.htm

- **Elsasser et al. (2009)** in their article "A Bibliography and database on forest benefit valuation studies from Austria, France, Germany and Switzerland" proposed a database with various descriptors that aims at facilitating transfer of these values. The database is provided as an Excel file and contains most of the existing studies in these countries. It is foreseen that the database will be open to direct and indirect proxy methods as well as eliciting methods of environmental valuation. The database descriptors follow the guidelines of the Swedish and US administrations ensuring that proper protocols were followed for its implementation (Elsasser et al., 2009).
- **ENVALUE**. The ENVALUE environmental valuation database is a systematic collection of environmental valuation studies presented in an on-line database. It was developed by the New South Wales Environmental Protection Agency of Australia. Its purpose is to assist decision makers in government and industry as well as academics, consultants and environmental groups, to incorporate environmental values into cost-benefit analyses, environmental impact statements, project appraisals and overall valuation of changes in environmental quality (New South Wales Government, 2014). The ENVALUE database is available at: http://www.environment.nsw.gov.au/envalueapp/
- **EXIOPOL** was a European Integrated Project (IP) coordinated by the Fondazione Eni Enrico Mattei (FEEM) in collaboration with The Netherlands Organisation for Applied Scientific Research (TNO). The EXIOPOL project on linking the monetary values of forests with their physical characteristics provides an Excel format database with a review of European studies of the valuation of some forest externalities, including recreation (Giergiczny et al., 2008). The EXIOPOL database is available at: http://www.feem-project.net/exiopol/

SCIENTIFIC BIBLIOGRAPHIC SEARCHING DATABASES

We also used Scientific Bibliographic searching databases to obtain available studies that were not already included in the previous sources. The searching databases used were Scopus and Science, and the keywords and queries used for the search are the following:

The Keywords used were:

- Valu* → valuation, value, valuing
- Recreation* → recreation, recreational
- Forest* → forest, forests
- Econom* → Economic, economy

And the queries were:

(valu AND recreation* AND forest*) AND (LIMIT-TO(PUBYEAR, 2014-1990) AND excluded non European countries* – provided 450 results

(valu AND ("Ecosystem services" OR recreation*) AND forest* AND econom*)* - provided 278 results

OTHER SOURCES

While performing the literature review, other studies were found and included in the database. These were mainly found because they were cited in other studies.

4.3 Results of the literature review

We compiled a total of 200 studies encompassing 458 records of forest recreation valuation. The studies that have been collected cover various publication types, including journal articles, project reports, PhD and MS theses, and book chapters. The literature is also diverse in terms of the objective of the research being carried out and valuation method used. The methods most commonly used are contingent valuation, used in 259 records, and travel cost, used in 154 records. However, some records using other valuation methods were also included in the database.

Care was taken to avoid double counting, for instance values reported by the same author in different value transfer studies. For estimates reported by the same author(s) in different studies, the oldest study was used, when possible.

The records in our dataset are from 25 countries. Most of the records are from Spain, United Kingdom and Germany. 374 records are at a local level, 39 at regional/province and 43 studies at National level, one at International level (Mediterranean region) and one has no information.

The final values in the database are measured in euros per hectare per year. However, not all the studies provide data for computing this metric. Most of the studies provide data about the willingness to pay, but many are missing sufficient information to calculate the value per hectare; i.e. the size of the selected sites or the number of visitors. An option for mitigating this issue was to collect the missing information from institutional sites of the national forest services or other official studies, or by contacting the authors. All the data found in ancillary sources rather than in the original studies were flagged in the database for their differentiation.

When the willingness to pay or total values in the original studies were provided as a range, the mean value was calculated to obtain a final value per hectare.

4.4 Standardization of values

Values were often referring to different years and expressed in different currencies and metrics. The first issue that must be addressed when conducting international value transfer is the conversion to

a common currency (Ready, 2006). Therefore, to allow for comparison, all the values per hectare per visit have to be adjusted to be referenced to a common date (2013) and metric (Euro). A simple transfer often assumes that recreational benefits vary proportionally with income, so transferred values were also adjusted by the relative difference between purchasing power parity (PPP) (Bartczak et al., 2008) and converted to Euro. This is a similar method followed by Ghermandi et al. (2008), Brander et al. (2006) and Woodward (2001).

This standardisation of values was performed in the following steps:

- Values referring to different years were deflated using GDP Implicit Price Deflators - National currency factors from the United Nations Statistics Division, for the years 1987 to 2012. As values for 2013 were still not available, these were estimated using the same percentage increase of the previous year; i.e. 2012.

  An implicit price deflator (IPD) is obtained by dividing a current price value by its real counterpart (the chain volume measure). When calculated from the major national accounting aggregates such as GDP, IPDs relate to a broader range of goods and services in the economy than that represented by any of the individual price indexes, such as CPIs, PPIs.

  The original value was converted to a value of 2013 using the following equation:

  VALUEadjusted2013 = VALUEoriginalyear * (IPD2013 / IPDoriginalyear)

  To implement this, a unique ID was created for all the records of the database for each combination of COUNTRY_YEAR. The same was done for the GDP Implicit Price Deflators. Then, a join was performed using Excel tools.

- All the different currencies were converted to Euros of 2013 using annual exchange rates data from Eurostat. This was also done by joining both tables in Excel.

- Identical individuals using different currencies will have the same real willingness to pay only if they have the same real income and face the same real prices. Thus, the appropriate exchange rate for converting values into a common currency is the exchange rate that equalizes market prices, and this type of exchange rate is called a purchasing power parity adjusted exchange rate (Ready, 2006). Therefore, the values measured in Euros and already adjusted by inflation, were adjusted by differences in purchasing power among the countries using the purchase power parity index provided by Eurostat.

The year taken into account for the calculations was the year of the evaluation study. When this year was not known, the year of the data (survey) was used.

4.5 Geographical location

For a spatial analysis of the results using GIS the geographical location of the records is needed. However, only few of the records provided geographical coordinates. To obtain their location the geographical database GeoNames (http://www.geonames.org/) was used.

The GeoNames geographical database is freely available under a creative commons attribution license. It contains around 10 million geographical names and consists of over 9 million unique features, of which 2.8 million are populated places and 5.5 million are other zones including natural areas and forest. All features are categorized into one out of nine feature classes and further subcategorized into one out of 645 features. GeoNames integrates geographical data such as names of places in various languages, elevation, population and others features from various sources. All latitude and longitude coordinates are in WGS84 (World Geodetic System 1984). When the location of the records could not be found using GeoNames, the coordinates were obtained, when possible, in institutional sites of the national forest services or in official documents.

All the coordinates acquired were converted to latitude/longitude decimal degrees (DD). A table with the geographical coordinates and the final recreational value of each record was exported to ArcGIS as a feature dataset (shapefile). Figure 1 shows the spatial distribution of the 446 records found in Europe where the recreational value of the forest was obtained.

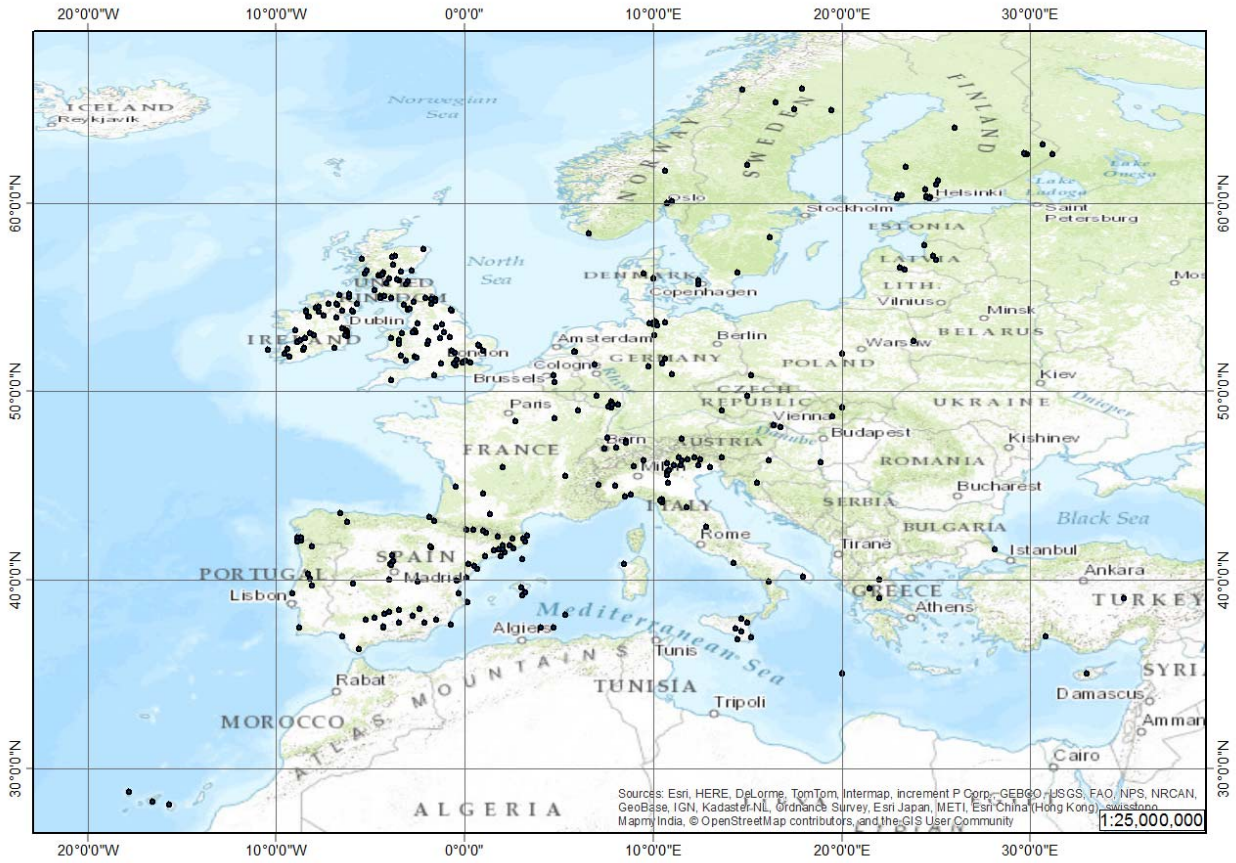

Figure 1. Spatial distribution of the records of the database of recreational value of forest.

However, as mentioned before not all the studies provided the necessary information to compute the annual value in Euro per hectare. The final 295 geo-referenced records with annual value per hectare are shown in Figure 2.

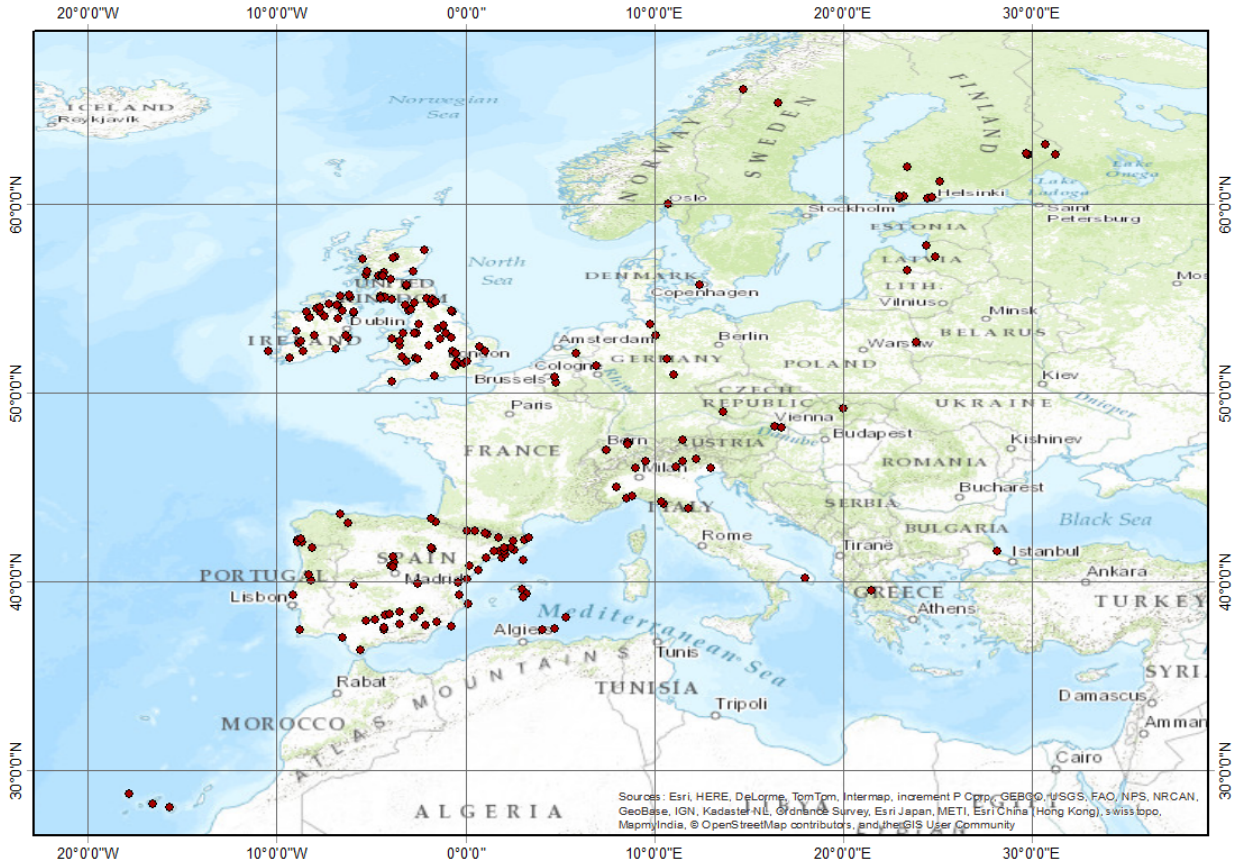

Figure 2. Spatial distribution of the records in the database of recreational value of forest having forest recreational value measured in Euro per hectare per year.

The shapefile contains the information of the study, including the ID, protection status, situation, name, method and final value, as shown in Figure 3. By using the ID the shapefile is linked to the main database in Excel containing all the information of each record.

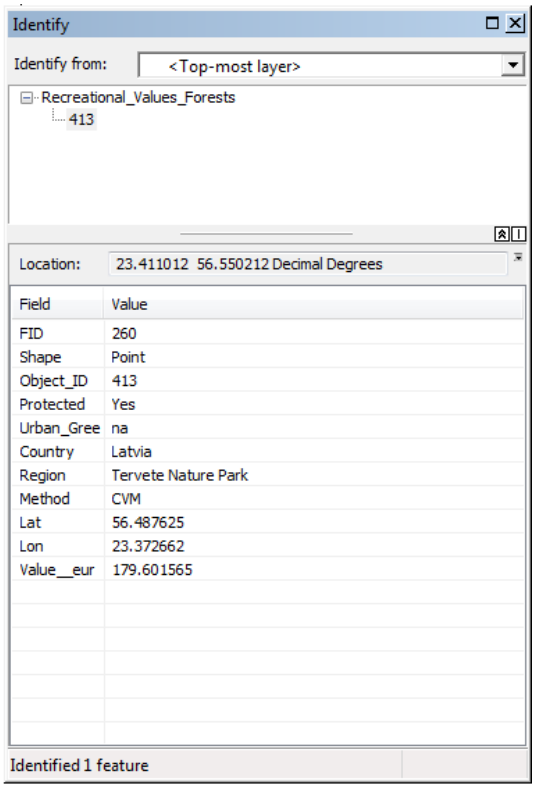

Figure 3. Record attributes in the database of recreational value of forest.

5. Conclusions and recommendations

In this study a database of the recreational value of forest was created with existing estimates in a way that could be useful for value transfer. The database contains 458 records from 200 valuation studies covering 309 forest sites in Europe. However, not all records provided sufficient information to calculate the annual value of the recreational service of forest per hectare per year. Finally, 295 records with the final value were geo-referenced. These will be used in further value transfer studies to estimate the recreational values of forests across Europe.

Analysis of the data indicates that there is a substantial variance in forest recreation values across studies, ranging from € 0.07 to € 2,033,370 per hectare per year with an average of € 14,569 and a median of € 121. The divergence of the average and the median suggests that very high values (outliers) may have an effect when using the data in value transfers. Therefore, it is suggested to evaluate this issue before using this dataset. For instance, eliminating seven outliers (> € 50,000 per hectare) gives an average of € 2,324 (median € 95) per hectare per year.

There is a rapidly growing amount of data on valuation of ecosystem services spread in many different places and stages of development. However, accessibility has often been a problem for many studies. Many valuation studies are either academic theses or reports to some funding organizations, and therefore, were not easy to find online. Furthermore, Information from primary studies is often scarce, incomplete and of varying quality.

Another issue was the language barriers, which might exclude many European studies from this review. Additionally, in the database some studies did not contain all the needed information to compute the recreational value per hectare. Further efforts would be needed to complete these gaps in the database.

There are many factors that may influence value transfer studies. Past studies have shown that values are influenced by the metrics of the valuation studies (e.g., value per trip, per day or per season), by the travel cost approach (i.e. zonal versus individual travel cost method), by the definition of costs (i.e. inclusion and level of opportunity cost of time, composition of car-borne travel costs) and other methodological features (e.g. inclusion of substitute sites, postal or face to face interviews, or specification of functional form of the meta-analysis) (Zandersen and Tol, 2009). Similarly, some studies concluded that including more information about the site-specific attributes, welfare measures and specifications of the valuation method will improve value transfer (Scarpa et al., 2000; Woodward, 2001; Zandersen et al., 2007; Zandersen and Tol, 2009). However, our results suggest that this is difficult to achieve in most cases, as this information is rarely available in valuation studies.

The travel cost method could be considered as a lower bound of the recreational value of forests when performing value transfer. In our database some studies provided values for the same study area using both travel cost and contingent valuation methods. This is useful for further analysis of the results.

Another point is that some studies reported marginal values while others reported total or average values. Costanza et al. (1997) assert that average productivity is more appropriate for the evaluation of large areas, while marginal values should be used in assessing small area values. Brander et al. (2006) and Ghermandi et al. (2008) assumed that marginal and average values are comparable. Moreover, one study contains the final value per household, instead of per person or per visit. This can be adjusted using the average household size of that country in that year.

6. Value transfer - Identification of explanatory spatial variables for GIS modelling

A value transfer regression model will use as the dependent variable (Y) the recreational value of the forests standardised to 2013 euros per hectare per year. For the identification of potential indicators and explanatory spatial variables a literature review was performed using different studies; e.g. Ghermandi et al. (2008), Brander et al. (2006) and Brouwer et al. (1997), that used meta-analysis for the valuation of wetlands, or Zandersen and Tol (2009) for forest recreational values.

The independent explicative spatial variables proposed would be:

- Study characteristics. Study characteristics accounted for in the model including:
    - The valuation method used (contingent valuation, travel cost, etc.): A dummy variable for each of the valuation methods could be included in the meta-regression model to account for the heterogeneity of methods
    - The year of publication
    - Dummy variable distinguishing between marginal and average values
- Recreational forest characteristics. Characteristics of the valued forest:
    - The size of the Recreational forest
    - The services provided
    - Dummy variable whether it is a protected area or not
    - Dummy variable whether it is urban forest
- Context: Environmental valuation studies carried out at different geographical sites and involving populations with different socio-economic characteristics and consumer preferences typically produce different outcomes. Suggested variables for assessment are:
    - GDP per capita
    - Population density (density of population living near the study site)
    - Forest abundance ratio
    - Distance to urban areas
    - Accessibility
    - Biodiversity levels

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References

Bartczak, A., Lindhjem, H., Navrud, S., Zandersen, M., and Zylicz, T.: Valuing forest recreation on the national level in a transition economy: The case of Poland, Forest Policy and Economics, 10, 467-472, 2008.

Bateman, I. J., and Jones, A. P.: Contrasting conventional with multi-level modelling approaches to meta-analysis: Expectation consistency in UK woodland ecreation values, in: Econometrics Informing Natural Resources Management: Selected Empirical Analyses, 281-315, 2005.

Benson, J. F. a. W. K. G.: Valuing informal recreation on the Forestry Commission Estate, University of Newcastle upon Tyne, London, 1989.

Brander, L. M., Florax, R. J. G. M., and Vermaat, J. E.: The empirics of wetland valuation: A comprehensive summary and a meta-analysis of the literature, Environmental and Resource Economics, 33, 223-250, 2006.

Brander, L. M., Ghermandi, A., Kuik, O., Markandya, A., Nunes, P. A. L. D., Schassfsma, M., and Wagtendonk, A.: Scaling up Ecosystem Services Values: Methodology, Applicability and a Case Study, Fondazione Eni Enrico Mattei, Milan, Italy, 43, 2010.

Brouwer, R., Langford, I. H., Bateman, I. J., Crowards, T. C., and Turner, R. K.: A meta-analysis of wetland contingent valuation studies, Working Paper - Centre for Social and Economic Research on the Global Environment, GEC 97-20, 1997.

Costanza, R., D'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., and Van Den Belt, M.: The value of the world's ecosystem services and natural capital, Nature, 387, 253-260, 1997.

EEA: Scaling up ecosystem benefits. A contribution to The Economics of Ecosystems and Biodiversity (TEEB) study European Environmental Agency, Union, O. f. O. P. o. t. E., Luxembourg, 39, 2010.

Elsasser, P., Meyerhoff, J., Montagné, C., and Stenger, A.: A bibliography and database on forest benefit valuation studies from Austria, France, Germany, and Switzerland - A possible base for a concerted European approach, Journal of Forest Economics, 15, 93-107, 2009.

European Commission: COM(2011) 244 final: Our life insurance, our natural capital: an EU biodiversity strategy to 2020, 2011.

European Commission: COM(2013) 659 final: A new EU Forest Strategy: for forests and the forest-based sector, European Commission, Brussels, 2013.

EVRI: The Environmental Valuation Reference Inventory (EVRI) https://www.evri.ca, access: 1st November 2014, 2014.

Ghermandi, A., van den Bergh, J. C. J. M., Brander, L. M., H.L.F., d. G., and Nunes, P. A. L. D.: The Economic Value Of Wetland Conservation and Creation: A Meta-Analysis, The Fondazione Eni Enrico Mattei, Milano, 20, 2008.

Giergiczny, M., Mavsar, R., and Wenchao, Z.: EXIOPOL. Report documenting the results of the metadata analysis linking the monetary values with the physical characteristics of forests, 2008

Haines-Young, R., and Potschin, M.: Common International Classification of Ecosystem Services (CICES): Consultation on Version 4, August-December 2012, EEA Framework Contract No EEA/IEA/09/003, 2013.

King, D. M., and Mazzotta, M. J.: Ecosystem Valuation: http://www.ecosystemvaluation.org/, access: 1st November, 2000.

Lindhagen, A.: Forest Recreation in Sweden. Four Case Studies Using Quantitative and Qualitative Methods, Doctoral thesis, Department of Environniental Forestry, SLU, 145 pp., 1996.

MAES: Mapping and Assessment of Ecosystems and their Services - Indicators for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020, Publications office of the European Union, Technical Report - 2014 - 080, Luxembourg, 80, 2014.

Matthews, D. I., Hutchinson, W. G., and Scarpa, R.: Testing the stability of the benefit transfer function for discrete choice contingent valuation data, Journal of Forest Economics, 15, 131-146, 2009.

Mendes, I. a. P., I.: Estimating the Recreation Value of Ecosystems by Using a Travel Cost Method Approach, Working Paper to be presented to the Permanent Seminar of the Department of Economics, 2005.

New South Wales Government: ENVALUE environmental valuation database: http://www.environment.nsw.gov.au/envalueapp/, access: 1st November, 2014, 2014.

Nielsen, A. B., Olsen, S. B., and Lundhede, T.: An economic valuation of the recreational benefits associated with nature-based forest management practices, Landscape and Urban Planning, 80, 63-71, 2007.

Ready, R. a. N., S.: International benefit transfer: Methods and validity tests, Ecological Economics, 60, 429-434, 2006.

Rekola, M. a. P., E.: Public preferences for uncertain regeneration cuttings: A contingent valuation experiment involving Finnish private forests, Forest Policy and Economics, 7, 635-649, 2005.

Riera, P., Signorello, G., Thiene, M., Mahieu, P. A., Navrud, S., Kaval, P., Rulleau, B., Mavsar, R., Madureira, L., Meyerhoff, J., Elsasser, P., Notaro, S., De Salvo, M., Giergiczny, M., and Dragoi, S.:

Non-market valuation of forest goods and services: Good practice guidelines, Journal of Forest Economics, 18, 259-270, 2012.

Scarpa, R., Hutchinson, W. G., Chilton, S. M., and Buongiorno, J.: Importance of forest attributes in the willingness to pay for recreation: A contingent valuation study of Irish forests, Forest Policy and Economics, 1, 315-329, 2000.

Stenger, A., Harou, P., and Navrud, S.: Valuing environmental goods and services derived from the forests, Journal of Forest Economics, 15, 1-14, 2009.

Sundberg, S., and Söderqvist, T.: ValueBaseSWE: A valuation study database for environmental change in Sweden, 2004.

TEEB: The Economics of Ecosystems and Biodiversity: Ecological and economic foundation, Earthscan Cambridge, 2010.

Tyrväinen, L., and Väänänen, H.: The economic value of urban forest amenities: An application of the contingent valuation method, Landscape and Urban Planning, 43, 105-118, 1998.

Van der Ploeg, S. a. R. S. d. G.: The TEEB Valuation Database – a searchable database of 1310 estimates of monetary values of ecosystem services. , 2010.

Voces González, R., Díaz Balteiro, L., and López-Peredo Martínez, E.: Spatial valuation of recreation activities in forest systems: Application to province of segovia (Spain), Forest Systems, 19, 36-50, 2010.

Woodward, R. T. a. W., Y. S.: The economic value of wetland services: A meta-analysis, Ecological Economics, 37, 257-270, 2001.

Zandersen, M., Termansen, M., and Jensen, F. S.: Evaluating approaches to predict recreation values of new forest sites, Journal of Forest Economics, 13, 103-128, 2007.

Zandersen, M., and Tol, R. S. J.: A meta-analysis of forest recreation values in Europe, Journal of Forest Economics, 15, 109-130, 2009.

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